Shearwater colonies on Montagu Island; are they being affected by encroaching Kikuyu Grass?

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Montagu Island (59 ha) is situated about 10 km east of Narooma on the New South Wales South Coast, at 36°15' S and 150°14' E. Three species of *Puffinus* Shearwater breed on the island in mixed colonies: the Wedge-tailed Shearwater *P. pacificus*, the Short-tailed Shearwater *P. tenuirostris* and the Sooty Shearwater *P. griseus* (Fullagar *et al.* 1993). Annual assessments of breeding success have been made since 1960 (Fullagar *et al.* 1991; Fullagar *et al.* 2004). A survey in 1997 indicated that the breeding population consisted of about 6300 pairs, of which 33% were Wedge-tailed Shearwaters, 66% were Short-tailed Shearwaters and 1% were Sooty Shearwaters (Fullagar and Heyligers 1998).

The vegetation has been extensively modified through human occupation, grazing of feral animals and intrusion of exotic plants (Heyligers and Adams 2004). Although Kikuyu Grass *Pennisetum clandestinum* has been present on the island for many decades, its rapid spread since the removal of goats *Capra hircus* in the late 1980s has caused some concern for the status of the Little Penguin *Eudyptula minor* breeding colony (Weerheim *et al.* 2003). Kikuyu overgrows and smothers other vegetation on the island, which, for the most part, is dominated by Mat-rush *Lomandra longifolia* (Heyligers 1993). Initially, runners spread through and over the Mat-rush tussocks. These tussocks collapse in a season or two while kikuyu develops into a dense tangled carpet that can be up to a metre thick.

Over the last decade we have witnessed the incursion of Kikuyu into one of three study plots used annually to assess shearwater breeding success. Each year at the end of March the vegetation cover is mapped and the location of shearwater burrows is plotted to a grid scale of c. 30 cm (12 inches). All chicks present are examined and banded (Fullagar *et al.* 1991). The numbers of chicks reared to fledging age varies considerably from year to year. In the particular study plot where Kikuyu has encroached, we find, on average, 58 Short-tailed Shearwater (max. 104) and 10 Wedge-tailed Shearwater (32) chicks, and occasionally one or two Sooty Shearwater chicks.

In 1993 the first runners of Kikuyu had entered this plot from the sward on the adjacent steep seaward slope and by 1994 Kikuyu covered a small area inside the plot (Fig. 1). Expansion was slow in the following years but accelerated after heavy rainfall during the summer of 1998-1999 (*vide* Tiller *et al.* in press). Since then it had been spreading at an average rate of about one metre per year. In 2003, shearwaters were still breeding in the area affected by this grass. Inspection of records from previous years showed that the small area covered by Kikuyu in 1994 contained no burrows, and the area covered by 1998 only one. By 2003, a year of average breeding productivity for shearwaters on Montagu Island, there were 24 burrows covered by Kikuyu. It so happened that 1998 was also a successful

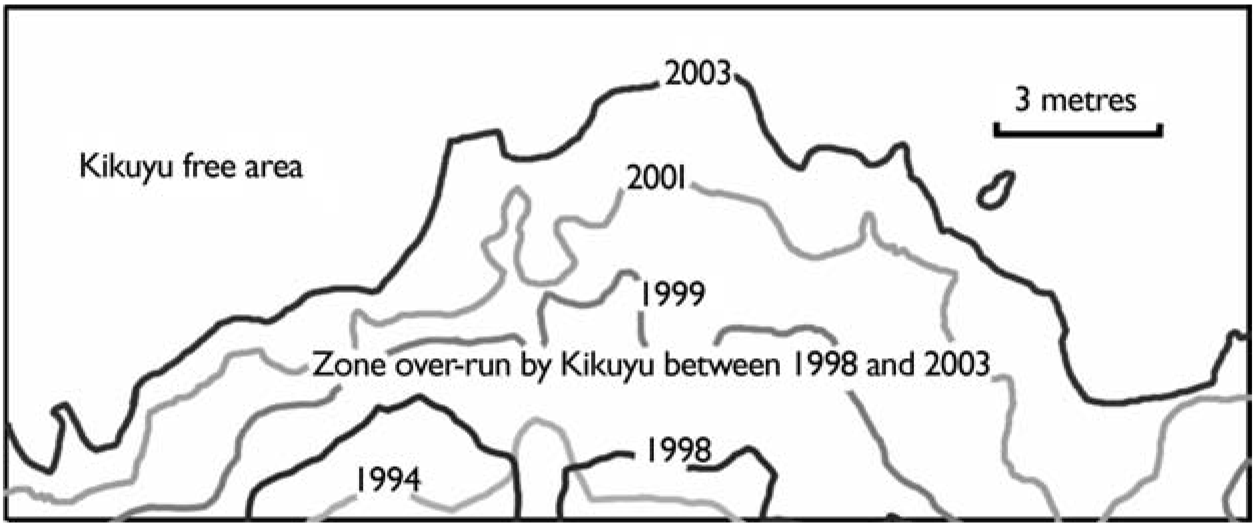

Figure 1. Diagram of the encroachment by Kikuyu into a shearwater colony on Montagu Island NSW between 1994 and 2003. This diagram represents the seaward section of the South Island Study Area (SISA) referred to by Fullagar and Heyligers (1998).

breeding season (a total of 57 Short-tailed Shearwater and 14 Wedge-tailed Shearwater chicks on this study plot), comparable with the 2003 season (60 Short-tailed Shearwater and 23 Wedge-tailed Shearwater chicks). Hence we decided to use data from these two seasons to assess the possible effect of Kikuyu intrusion.

We examined the numbers of burrows present, in 1998 and 2003, within the zone between the boundary of the Kikuyu plotted in 1998 and the boundary plotted in 2003, i.e. the zone that was free of Kikuyu in 1998 but overrun by 2003. To put these numbers in context, we also examined the number of burrows in an area adjacent to this Kikuyu zone of roughly equivalent size. The numbers of occupied burrows of both species have increased in the zone now covered by Kikuyu (Fig. 2). An increase in Wedge-tailed Shearwater burrows has also occurred in the adjacent area, but burrows occupied by Short-tailed Shearwaters have slightly decreased in the unaffected adjacent area. Numbers of empty burrows in both seasons have shown little if any change.

Within the area overrun by Kikuyu, there was no demonstrable decrease between 1998 and 2003 in either the total number of burrows, the proportion of burrows occupied or the number of fledglings. Within the area free from Kikuyu, the total number of burrows present in 2003 (n=37) was unchanged from the number present in 1998. Although the ratio of the two species of shearwaters changed substantially between 1998 and 2003 (15:2 compared with 12:7), the total number of fledglings present each year was similar (17 compared with 19), as was the proportion of burrows occupied (0.46 compared with 0.51). Within the area overrun by Kikuyu, the ratio of the two shearwaters changed from 6:2 in 1998 to 9:5 in 2003. The total number of burrows present in 2003 (n=24) exceeded the number present in 1998 (n=18). The proportion of occupied burrows also increased, from 0.44 in 1998 to 0.58 in 2003. Although small sample sizes and lack of replication preclude any rigorous statistical testing of these difference, the trend is towards an increased, rather than a reduced, density of burrows and fledglings within the area affected by Kikuyu.

At this stage Kikuyu has not invaded much of the areas known to be used by breeding shearwaters on Montagu Island (see maps in Fullagar and Heyligers 1998; Weerheim *et al.* 2003). The fact that breeding productivity does not seem to have been affected in our study area was unexpected because the prevailing idea is that seabird breeding activity is adversely affected once Kikuyu takes over from more open native vegetation. After the removal of goats in the in late 1980s (Pacey 2001), a rapid expansion of Kikuyu occurred. Untimely removal of a browsing or grazing mammal often results in explosive and disastrous growth of exotic weeds (Crooks and Soulé 1999). On Montagu Island, invasion by Kikuyu has been shown to lead to a deterioration of breeding conditions for Little Penguin (Weerheim *et al.* 2003). Our findings may not be so surprising because shearwaters, unlike Little Penguins, are long-lived birds and they exhibit high breeding site fidelity (Wooller *et al.* 1990). Such traits may lead to the persistent use of a long established site even in the face of increasing depth and entanglement of vegetation at the burrow entrance. Whether new breeding pairs can establish burrows under dense and matted kikuyu is another question. At the present rate of expansion our study plot might well have been engulfed by this grass within 20 years. During the winter following our survey in 2003, Kikuyu grass was eradicated from the plot using herbicide (Fullagar *et al.* 2004). We can only conclude that ten years was not long enough to reveal the consequences of Kikuyu grass invading this shearwater colony.

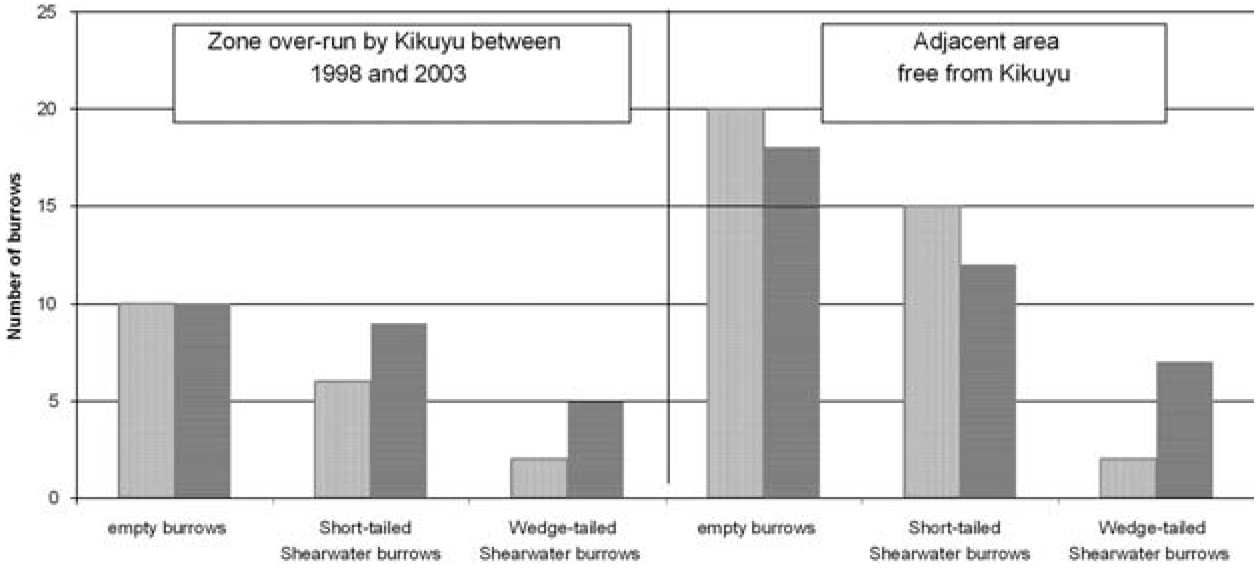

Figure 2. Paired comparisons of burrow counts (empty burrows, Short-tailed Shearwater burrows, wedge-tailed Shearwater burrows) made in 1998 (left bar) and 2003 (right bar) on the section of the study plot used to asses the effects on shearwaters numbers following encroachment by Kikuyu.

Acknowledgments

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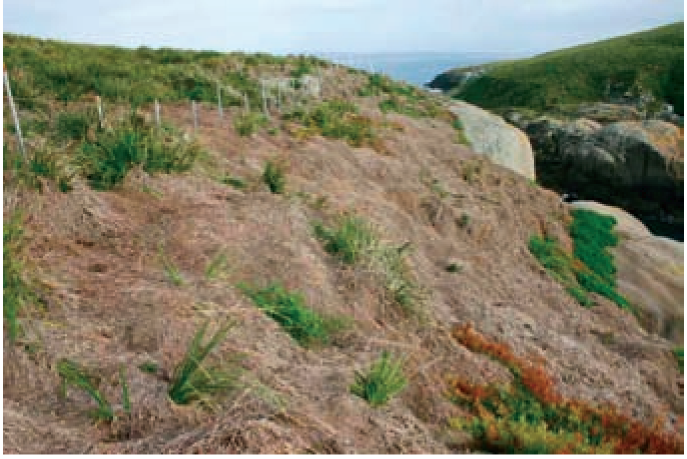
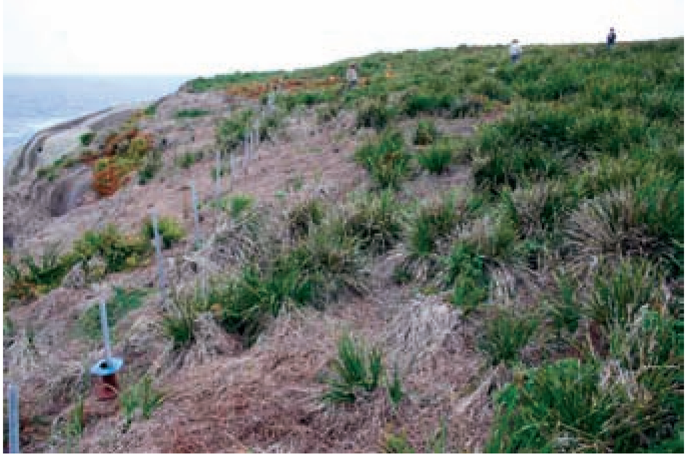
APPENDIX I



View westwards along northern edge of our study area on Montagu Island in April 2004. Following treatment with herbicide (the previous winter) the mat of dead Kikuyu Grass *Pennisetum clandestinum* is clearly visible.

Photo: P. Fullagar



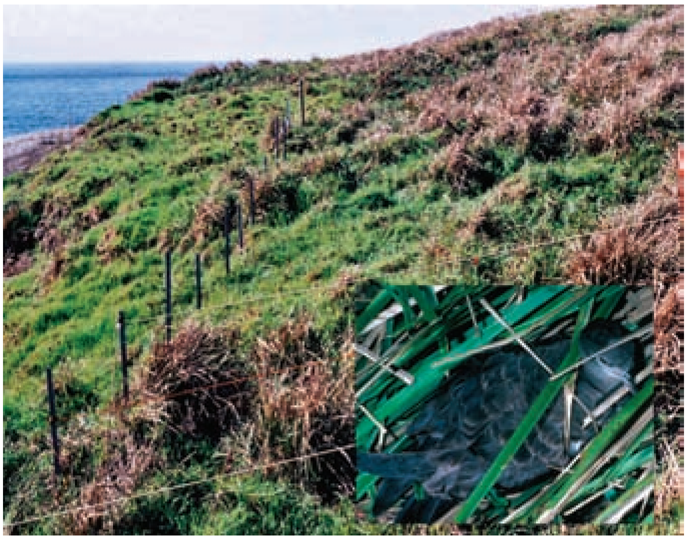
View eastwards along northern edge of our study area on Montagu Island in April 2004. This view shows more clearly the extent of intrusion by Kikuyu Grass into the study site.

Photo: P. Fullagar

APPENDIX I

Portrait of late stage chick of a Sooty Shearwater *Puffinus griseus* one of the three species of shearwater that breed on our Montagu Island study plot.

Photo: P. Fullagar



View, in March 2003, of the northern boundary of the study area on Montagu Island, NSW in which Kikuyu Grass *Pennisetum clandestinum* has encroached into a mixed colony of three species of *Puffinus* shearwaters.

Inset: an adult Wedge-tailed Shearwater *P. pacificus* amongst Mat-rush *Lomandra longifolia.*

Photos: P. Heyligers and P. Fullagar.

Enlargement of inset above.